Comparative Assessment of Compomers and Ormocers as Pit and Fissure Sealants in Permanent Molars among Children Aged 7–9 Years

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Abstract

Introduction: In recent years, the dental profession's focus has shifted from the therapeutic to the preventive aspect of dental caries. Pit and fissure sealants, optimal fluoridation, healthy dietary habits, and good oral hygiene have been recommended for caries prevention. Many sealant materials are available on the market. Compomers are hybrid dental materials that are modified composite resins with polyacids. The esthetic properties of traditional composite systems are combined with the fluoride-releasing and adhesive properties of glass ionomer cement (GIC). Organically modified ceramic (Ormocer) material has high abrasion resistance and better aesthetics, similar to natural teeth.

Aim: To compare the sealing ability of compomer and ormocer as pit and fissure sealants in permanent mandibular first molars of 7–9-year-old children.

Materials and methods: A cross-sectional study with a split-mouth design was conducted on 88 children aged 7–9 years who attended the Department of Pediatric and Preventive Dentistry. Children were selected based on the inclusion and exclusion criteria. By tossing a coin, the placement of sealant material was selected for the right permanent first molar. Rubber dam isolation was done. The tooth surface was etched and washed. The respective sealants were applied. Sealants were cured with visible light, and occlusion was checked with articulating paper. Subsequently, the second sealant was placed in the next appointment, following the same clinical procedure in the opposite quadrant. Clinical evaluation was done at 3, 6, and 9 months for retention, marginal integrity, color match, wear, and presence of caries. The criteria were graded and rated as alpha, beta, and charlie based on modified Ryge United States Public Health Service (USPHS) criteria. All the data were statistically analyzed using Statistical Package for the Social Sciences (SPSS) software 20.0.

Results: The retention rate of ormocer at the 9-month review interval was 88.3%. There was a statistically significant difference in retention rates between compomer and ormocer (p = 0.003). The marginal integrity and wear of ormocer at the 9-month review interval were 84.4% compared with compomer, which was statistically significant with p = 0.010 and p = 0.035, respectively. Children with the fewest caries belonged to the ormocer group (p = 0.010) compared to the compomer group.

Conclusion: Children with ormocer as a pit and fissure sealant showed good retention, remarkable marginal integrity, absence of wear, and fewer dental caries compared to compomer sealants. Hence, ormocer-based sealants can be used in pediatric dental practice to protect children's oral hygiene and promote a healthy lifestyle.

Keywords: Dental caries, Pediatric dentistry, Pit and fissure sealants.

International Journal of Clinical Pediatric Dentistry (2024): 10.5005/jp-journals-10005-2954

INTRODUCTION

Dental caries is a complex disease, producing an imbalance in the demineralization and remineralization processes.¹ Numerous preventive measures are reducing the prevalence of caries, although they are ineffective on occlusal surfaces that are more vulnerable to caries.² Caries in the pits and fissures account for 44% in the primary dentition, 90% in permanent dentition, and predominantly affect the occlusal surface.^{3–7} Sealants provide a micromechanically bonded protective layer that inhibits the invasion of caries-producing bacteria.^{8,9}

Nagano in 1961 classified pits and fissures as U, V, I, IK, and inverted Y types. Schroder in 1982 and Rohr in 1991 classified pits and fissures as U, V, Y1, and Y2 and described the depth of the gap in fissure bottoms as shallow, deep, and intermediate types.^{10,11} Deep, narrow, IK, or I-shaped fissures were more susceptible to caries compared to wide, U-shaped fissures.¹² Fissure sealant using glass ionomer cement (GIC) showed low retention and was first introduced by McLean and Wilson.^{13,14} There have been studies comparing sealant materials of GIC with resin sealants.^{15,16}

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How to cite this article: Saravanan SM, Srinivasan D, AR SE, *et al.* Comparative Assessment of Compomers and Ormocers as Pit and Fissure Sealants in Permanent Molars among Children Aged 7–9 Years. Int J Clin Pediatr Dent 2024;17(7):742–747.

Source of support: Nil

Conflict of interest: None

Polyacid-modified composite resins are called compomers and were introduced in 1990.¹⁷ Compomers are a hybrid of modified composite resins combined with polyacids. Disadvantages of resinbased sealants include shrinkage due to polymerization, which could cause microleakage and allow bacteria and saliva to pass

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through the occlusal barrier.¹⁸ A novel substance based on silicon dioxide called ormocer was introduced in 1998.¹⁹ Ormocers are made of monomer molecules, which decrease the effects of wear, shrinkage, and leaching of the estrogenic chemical bisphenol-A.²⁰

Thus, this study was conducted to compare compomerpolyacid modified resin-based sealants and ormocer-organically modified ceramic-based sealants. To assess and compare the clinical performance of two pit and fissure sealants—compomer-based Twinky Star and ormocer-based Admira Flow—the study evaluated retention, wear, color match, marginal integrity, and the presence of caries at 3, 6, and 9 months.

Аім

To evaluate the sealing efficacy of compomer and ormocer in pit and fissure caries in permanent mandibular first molars among children aged 7–9 years.

OBJECTIVES

The study compared parameters such as retention, wear, marginal integrity, color match, and presence of caries between two sealing materials (compomer and ormocer) in permanent mandibular first molars among children aged 7–9 years.

MATERIALS AND METHODS

This cross-sectional study with a split-mouth design was conducted to evaluate the sealing efficacy of two pit and fissure sealants (compomer and ormocer) placed on the occlusal surface of the pits and fissures of a first mandibular permanent molar among children aged 7–9 years. Ethical approval was obtained before the conduct of the study from the Institutional Human Ethics Committee (No. 673/ IHEC/12–19). The sample size of the study was calculated using G*Power application 3.0.10 as 88. The parents were briefed about the study, and written consent was obtained.

Inclusion Criteria

- Children of both genders aged 7–9 years with fully erupted permanent mandibular first molars.
- Parents who agreed to participate in the study.
- Fully erupted permanent first molars in the lower quadrants, accompanied by deep, retentive pits and fissures.
- Presence of sound proximal surfaces of the tooth.

Exclusion Criteria

- Patients with bruxism, malocclusion, or allergies to dental resins or latex.
- Parents who refused to participate in the study.
- Wide self-cleansing pits and fissures.
- Presence of proximal caries.
- Deep caries requiring restoration or deep caries involving the pulp.
- · Children not cooperating for the treatment.

The patient was seated comfortably. The sealant material was decided by the toss of a coin. Rubber dam isolation was performed. All the armamentarium required for the treatment, such as sealants, etchant, bonding agent, and curing light, were kept ready (Fig. 1). The tooth surface was etched, and the selected sealant was applied (Figs 2 and 3). The sealant was cured under visible light, and occlusion was verified using articulating paper. The other sealant was applied in the following appointment using the same procedure. A pilot study was conducted to check interrater reliability and validity.

The intraoral photography of the sealant placed was taken by the same investigator during the entire review process. A clinical



Fig. 1: Armamentarium 1



Fig. 2: Armamentarium 2



Fig. 3: Compomer and ormocer pit and fissure sealants

evaluation was conducted at 3, 6, and 9 months to assess retention, wear, color match, marginal integrity, and the presence of cavities. Three ratings for the criterion were assigned: alpha, beta, and charlie.

The investigators reviewed all the parameters for the modified United States Public Health Service (USPHS) criteria using both visual and photographic methods.

Modified USPHS/Ryge Clinical Criteria

Criteria	Sealant position
Retention	Alpha—present Bravo—partially present Charlie—lost
Marginal integrity	Alpha—excellent margin with no evidence of caries Bravo—an acceptable margin with a small crevice detected Charlie—an unacceptable margin with a larger crevice present
Color match	Alpha—no mismatch Bravo—slight mismatch but clinically acceptable Charlie—unacceptable mismatch
Wear (anatomic form)	Alpha—anatomy resembles original restoration Bravo—anatomy shows change in contour but do not require replacement Charlie—excessive wear with dentin exposure requiring replacement
Presence of caries	Alpha—absent Bravo—present

RESULTS

A randomized clinical trial was conducted among 7–9-year-old children in permanent mandibular first molars at the Department of Pediatric and Preventive Dentistry to assess the sealing effectiveness of two pit and fissure sealants (Compomer and Ormocer).

Table 1 shows the age and gender-wise distribution of the study participants.

Table 2 shows the intergroup comparison of compomer and ormocer at the 3rd month. The retention, marginal integrity, color

match, and wear resistance were better with ormocer. The caries incidence was lower with ormocer compared with compomer.

Table 3 shows the intergroup comparison of compomer and ormocer at the 6th-month review. The retention, marginal integrity, color match, and wear resistance were better with ormocer and were found to be statistically significant. The caries incidence was lower with ormocer.

Table 4 shows the intergroup comparison of compomer and ormocer at the 9th-month review. The retention, marginal integrity, color match, and wear resistance were good with ormocer. The recurrence of caries was lower with ormocer compared with compomer.

Table 5 shows the failure and the loss of follow-up at the end of the 3rd month. Five patients were recorded as a failure in sealants. At the end of the 6th month, seven patients were recorded as a failure in sealants and four patients were in the loss of follow-up. At the end of the 9th month, 14 patients were recorded as a failure in sealants and two patients were in the loss of follow-up.

DISCUSSION

Dental caries is among the most prevalent diseases worldwide. It has long been known that the occlusal pits and fissures of posterior

Table 1	1: Age and	l gender-wise	distribution	of study	participants

		N (%)	
Age-group in years	Male	Female	Total
7–8	21 (23.9)	19 (21.6)	40 (45.5)
8–9	23 (26.1)	25 (28.4)	48 (54.5)
Total	44 (50.0)	44 (50.0)	88 (100)

Table 2: II	ntergroup comparison of compomer and ormocer at 3 months
review usi	ing Chi-squared test

		Α	В	С	p-value
Retention	Compomer	57	26	1	0.009
		67.9%	31%	1.1%	
	Ormocer	76	11	0	
		87.4%	12.6%	0.0%	
Marginal	Compomer	59	24	1	0.058
integrity		70.2%	28.6%	1.2%	
	Ormocer	74	12	1	
		85%	13.7%	1.3%	
Color	Compomer	84	0	0	0.17
		100%	0	0	
	Ormocer	87	0	0	
		100%	0	0	
Wear	Compomer	65	18	1	0.288
		77.3%	21.4%	1.3%	
	Ormocer	73	14	0	
		84%	16%	0.0%	
Dental	Compomer	83	1	-	0.235
caries		98.8%	1.2%	-	
	Ormocer	87	0	-	
		100%	0	-	

teeth are highly susceptible to caries. Deep pits and fissures promote food retention and are challenging to clean with regular brushing. This creates an ideal environment for oral microorganisms to thrive, resulting in enamel demineralization.

The American Dental Association 2016 advocates the use of dental sealants as an effective preventive method for occlusal pit and fissure caries control.²¹ This randomized clinical trial was conducted to assess the sealing effectiveness of two pit and fissure sealants (compomer and ormocer) placed in permanent lower first molars among children aged 7–9 years. Pit and fissure sealants using GIC and composites have been previously studied.^{22,23} The various sealant materials include cyanoacrylate resins, polyurethane, glass, bisphenol A glycidyl methacrylate resins, GIC, polyacid-modified composite resins (compomers), and recently ormocers.^{24,25}

Biocompatibility, retention, and resistance to wear and abrasion are all characteristics of an ideal sealing material.²⁶ Compomer showed lesser retention at 3, 6, and 9 months compared to ormocer. This is in accordance with Pardi et al.²⁷

The retention of ormocer-based sealant in the current study is higher compared to Guler and Yilmaz²⁸ (2013), where retention rates were 64 and 70% at 12- and 18-month intervals. Yilmaz et al.²⁹ (2010), on comparing four different sealants, stated that compomer had 11% retention and ormocer had 33% retention at a 12-month interval. The wide variation could be due to the split-mouth design

Table 3: Intergroup comparison of compomer and ormocer at 6 monthsreview using Chi-squared test

not being used to compare the compomer and ormocer groups in their study.

Dukić et al.³⁰ (2007) used ormocer (Admira Flow) and found 74.5% total retention at a 12-month interval. The present study with the same material, Admira Flow, has shown 88.3% retention at a 9-month interval. The reason could be the use of a different bonding agent (Tetric N-Bond) in the present study. The matrix of ormocer is made of multifunctional urethane-thioether methacrylate alkoxysilane, which has a lower amount of organic resin and free monomers, contributing to increased retention.

Marginal integrity is a key factor in evaluating pit and fissure sealants because stepped margins contribute to plaque accumulation and the development of caries.^{31,32} The present study showed marginal integrity of compomer at 3, 6, and 9 months to be 70.2, 73, and 78.7%, respectively. The marginal integrity of ormocer at 3, 6, and 9 months was 85, 82.1, and 84.4%, respectively. This is in accordance with Gungor et al.³³ The higher marginal integrity in ormocer is attributed to its lower shrinkage during polymerization.³⁴ The better marginal integrity is statistically significant at the 6-month (p = 0.025) and 9-month (p = 0.010) reviews.

Wear of the tooth is the result of a process involving the abrasive nature of food, thickness, and hardness of the enamel, as well as chewing behaviors and neuromuscular forces.³⁵ Pardi et al.³⁶ (2008) stated that the compomer underwent more wear

 Table 4:
 Intergroup comparison of compomer and ormocer at 9 months

 review using Chi-squared test
 Intergroup comparison of compomer and ormocer at 9 months

		Results						Results			
		A	В	С	p-value			Α	В	С	p-value
Retention	Compomer	50	22	2	0.003	Retention	Compomer	45	13	3	0.003
netention	componiei	67.5%	30%	2 5%	0.005			73.8%	21.3%	4.9%	
	Ormocer	72	12	0			Ormocer	68	8	1	
	011100001	85.7%	14.3%	0.0%				88.3%	10.3%	1.4%	
Marginal	Compomer	54	17	3	0.025	Marginal	Compomer	48	9	4	0.010
integrity		73%	23%	4%		integrity	·	78.7%	14.7%	6.6%	
	Ormocer	69	15	0			Ormocer	65	11	1	
		82.1%	17.9%	0.0%				84.4%	14.3%	1.3%	
Color	Compomer	74	0	0	0.029	Color	Compomer	61	0	0	0.003
		100%	0	0				100%	0	0	
	Ormocer	84	0	0			Ormocer	77	0	0	
		100%	0	0				100%	0	0	
Wear	Compomer	59	14	1	0.10	Wear	Compomer	51	9	1	0.035
		79.7%	18.9%	1.4%				83.6%	14.7%	1.7%	
	Ormocer	69	15	0			Ormocer	65	11	1	
		82.1%	17.9%	0.0%				84.4%	14.2%	1.4%	
Dental	Compomer	73	1	0	0.052	Dental caries	Compomer	59	2	0	0.010
caries		98.7%	1.3%	0				96.7%	3.3%	0	
	Ormocer	84	0	0			Ormocer	76	1	0	
		100%	0.0%	0				98.7%	1.3%	0	

Table 5: Failure and loss of follow-up table

	Failed (months)				Loss of follow-up			
Sealant materials	3 months	6 months	9 months	Total	3 months	6 months	9 months	Total
Compomer	4	7	10	21	0	4	2	6
Ormocer	1	0	4	5	0	4	2	6

than unfilled resin sealant and flowable composite. According to USPHS criteria, an alpha rating for wear indicates that a material placed resembles anatomical restoration. In the present study, wear of compomer was more compared to ormocer. Compomer probably had not penetrated properly into the pits and fissures, which leads to early wear off.

Colored sealants help in evaluation during recall visits. The use of colored sealants assists both the investigator and the parent in ascertaining the presence of the sealant. There has been a lack of availability of colored ormocer as a sealant; thus, tooth-colored ormocer and blue-colored compomer were used in the present study. Discoloration of the sealant material was checked during the recall visits by both visual and photographic examination. There was a statistically significant difference in color stability between the two groups at the 6-month (p = 0.029) and 9-month (p = 0.003) reviews.

In the present study, cases in which the sealant had dislodged or fractured were refilled and removed from the study sample. They were counted as failure cases. Llodra et al.³⁷ (1993) and Gomez et al.³⁸ (2005) stated that a single placement of sealant wears off over time. In the present study, ormocer showed no incidence of dental caries at the 3-, 6-, and 9-month intervals. This is attributed to ormocer releasing a lower concentration of fluoride over a long period, which contributes to the cariostatic effect.

CONCLUSION

- A split-mouth design study was done to evaluate the sealing efficacy of two pit and fissure sealants (compomer and ormocer) placed on the occlusal surface of the pits and fissures of first permanent mandibular molars among children between 7 and 9 years.
- Based on modified USPHS criteria, ormocer-based sealants showed better clinical results than compomer-based sealants in relation to retention, wear, marginal integrity, color match, and occurrence of dental caries at 3, 6, and 9 months.
- Therefore, sealants based on ormocer could be applied in pediatric dentistry.

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